

Idaho National Engineering & Environmental Laboratory
Bechtel BWXT Idaho LLC.

B&K GAS ANALYZER

Summary:

The B+K Gas Analyzer is a photoacoustic gas analyzer.

In 2001 the analyzer was first used in the waste zone at the RWMC to analyze vapor samples from the Type-B probes. VOC and water vapor analysis is conducted on location after samples are taken from the Type B Vapor ports. 299 vapor samples are planned for the duration of the integrated probing project. An approximate cost of \$3400 per analysis was provided by the Sample Management Office for independent off-site labs. This could result in an annual savings to the project of about \$303,400. Over the course of the next three years this would add up to a cost savings of over \$941,000.

This equipment was first used on the OCVZ project to analyze VOC, and water vapor returns. The ability to sample and analyze on-site reduces schedule and avoids the cost of off-site laboratory analysis.

At OCVZ: On a monthly basis the project is sampling 32 well locations, each with multiple ports, resulting in approximately 110 samples per month. The plan is to increase that number by about 20 samples starting in August. A total of 67 hours is allotted for completion of the monthly sampling/analysis event. At this current rate, this ends up costing the project just under \$7000. per month. If the annual cost for standard gases, Tedlar bags, and calibration of the B&K, is averaged that cost might increase to around \$7500 per month.

The Sample Management Office has provided a pricing schedule for sending vapor samples off-site to Southwest Research Institute. Each sample would cost just over \$3000. Multiply this by the 110 samples and this becomes over \$300,000 per month. This estimate included rental of SUMMA canisters and individual shipping costs. Purchasing the SUMMA canisters and sending the samples in a bulk shipment would reduce the cost to some extent over the long term, but its still clear that the costs would far exceed the price of using the B&K and doing the analysis on-site.

Using the B&K (a photoacoustic gas analyzer) does increase data variability and reduces accuracy to some degree, but in light of the financial benefits, the project decided that this is the best fit for its needs.

Qualitative Benefit Analysis

Programmatic Risk



Significant savings in time and money greatly reduces programmatic risk. Sending all these samples to an off-site lab would hinder completion of these projects.

Technical Adequacy	<input checked="" type="radio"/>	The gas analysis done on-site is accurate and reliable. Analysis conducted at an off-site laboratory would be more accurate and have reduced variability, but cost would be much higher.
Safety	<input type="radio"/>	There are no appreciable changes to the safety of the project.
Schedule Impact	<input checked="" type="radio"/>	Much less time is taken by using this on-site analysis. The turnaround time for off-site laboratory analysis is significant. It would be impossible to process this number of samples in a timely manner if off-site analysis was required.

<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Major Improvement	Some Improvement	No Change	Somewhat Worse	Major Decline

Quantitative Benefit Analysis							
Cost Impact Analysis	<p>There is significant cost avoidance in the form of no off-site lab analysis at the OCVZ project alone. Off-site analysis would cost approximately \$3000 per sample and 110 samples per month that is \$330,000 per month. This amount minus the \$7500 per month being spent with the B&K is \$322,500 saved per month or \$3,870,000 per year. Assuming a lifetime of ten years this equals a potential cost savings of nearly \$40 million.</p> <p>The Type B probing campaign has life-cycle cost avoidance of another \$941,100. 299 samples are planned for the life of the project. The off-site analysis cost of \$3,400 each versus approximately \$102 for on-site analysis adds up quickly to a savings of around \$986,100. \$45,000 cost of the equipment is deducted from this for the \$941,100 figure.</p> <table> <tr> <td>Annual Savings (combined)</td><td>\$4.17 M</td></tr> <tr> <td>Life Cycle Cost Savings (combined)</td><td>\$39.6 M</td></tr> <tr> <td>Return-On-Investment (ROI)</td><td>8004% and 643%</td></tr> </table>	Annual Savings (combined)	\$4.17 M	Life Cycle Cost Savings (combined)	\$39.6 M	Return-On-Investment (ROI)	8004% and 643%
Annual Savings (combined)	\$4.17 M						
Life Cycle Cost Savings (combined)	\$39.6 M						
Return-On-Investment (ROI)	8004% and 643%						

Worksheet 1: Operating & Maintenance Annual Recurring Costs

Expense Cost Items *	Before (B) Annual Costs	After (A) Annual Costs
1. Equipment	\$ -	\$ -
2. Purchased Raw Materials and Supplies	\$ -	\$ -
3. Process Operation Costs:		
Utility Costs	\$ -	\$ -
Labor Costs	\$ 312,800.00	\$ 6,900.00
Routine Maintenance Costs for Processes	\$ -	\$ 2,500.00
Subtotal	\$ 312,800.00	\$ 9,400.00
4. PPE and Related Health/Safety/Supply Costs	\$ -	\$ -
5. Waste Management Costs:		
Waste Container Costs	\$ -	\$ -
Treatment/Storage/Disposal Costs	\$ -	\$ -
Inspection/Compliance Costs	\$ -	\$ -
Subtotal	\$ -	\$ -
6. Recycling Costs		
Material Collection/Separation/Preparation Costs:		
a) Material and Supply Costs	\$ -	\$ -
b) Operations and Maintenance Labor Costs	\$ -	\$ -
Vendor Costs for Recycling	\$ -	\$ -
Subtotal	\$ -	\$ -
7. Administrative/other Costs (planner)	\$ -	\$ -
Total Annual Cost:	\$ 312,800.00	\$ 9,400.00

* See attached Supporting Data and Calculations.

Worksheet 2: Itemized Project Funding Requirements*
(i.e., One Time Implementation Costs)

Category	Cost \$
INITIAL CAPITAL INVESTMENT	
1. Design	\$ -
2. Purchase	\$ 45,000
3. Installation	\$ -
4. Other Capital Investment (explain)	\$ -
Subtotal: Capital Investment= (C)	\$ 45,000
INSTALLATION OPERATING EXPENSES	
1. Planning/Procedure Development	\$ -
2. Training	\$ -
3. Miscellaneous Supplies	\$ -
4. Startup/testing	\$ -
5. Readiness Reviews/Management Assessment/Administrative Costs	\$ -
6. Other Installation Operating Expenses (explain)	\$ -
Subtotal: Installation Operating Expense = (E)	\$ -
7. All company adders (G & A/PHMC Fee, MPR, GFS, Overhead, taxes, etc.)(if not contained in above items)	\$ -
Total Project Funding Requirements=(C + E)	\$ 45,000
Useful Project Life = (L) 3 Years Time to Implement: 0 Months	
Estimated Project Termination/Disassembly Cost (if applicable) = (D)	\$ -
(Only for Projects where L<5 years; D=0 if L>5 years)	
TOTAL LIFE-CYCLE COST SAVINGS CALCULATION FOR IPABS-IS	
(Before - After) x (Useful Life) - (Total Project Funding Requirements + Termination)	
Total Life Cycle Cost Savings Estimate = (B - A) x L - (C+E+D)	\$941,050
RETURN ON INVESTMENT CALCULATION	
Return on Investment (ROI) % =	
$\frac{(Before - After) - [(Total Project Funding Requirements + Termination)/Useful Life]}{[Total Project Funding Requirements + Project Termination]} \times 100$	
$ROI = \frac{B-A-[(C+E+D)/L]}{(C+E+D)} \times 100 = 643 \%$	
O&M Annual Recurring Costs:	Project Funding Requirements:
Annual Costs, Before= \$ 312,800 (B)	Capital Investment= \$ 45,000 (C)
Annual Costs, After= \$ 9,400 (A)	Installation Op. Exp= \$ - (E)
Net Annual Savings= \$ 303,400 (B-A)	Total Project Funds= \$ 45,000 (C+E)
Note: Before (B) and After (A) are Operating & Maintenance Annual Recurring Costs from Worksheet 1.	

Basis for Estimates

1	Equipment
The cost of the B+K Analyzer is \$45,000.	

2	Purchased Raw Materials and Supplies
Sampling supplies consist of Tedlar bags, calibration costs, and gases. The cost for these supplies is equivalent for on-site versus off-site analysis.	

3	Process Operation Costs:
<p>Utility Costs Cost to operate the analyzer is minimal.</p> <p>Labor Costs On-site analysis of samples generated by the Type B probing campaign has saved considerable funding versus the cost of sending the samples to an off-site lab. The cost per sample for off-site analysis is approximately \$3,400. The labor associated with the B+K analyzer is 1 hour at \$75 per sample. This plus the cost of one calibration per year at \$2,500 divided by the number of samples is approximately \$102 per sample. Therefore there is a \$3,298 savings per sample. This project is scheduled to continue through FY 2004. Quarterly sampling is planned for the duration of the integrated probing campaign with one round scheduled for 2001, and 4 for '02, '03 and '04. 24 of the 30 vapor ports are going to be sampled during each sampling round. Of these 1 will be sent off-site for comparison. This leaves 23 samples utilizing the B+K each round. This leads to 92 samples per year plus 23 more for 2001. These add up to 299 samples at \$3,298 saved to produce \$986,102 in cost avoidance. When the cost of an analyzer is subtracted from this there is a net savings of about \$941,000.</p> <p>Routine Maintenance Costs for Processes There are annual calibration costs of \$2,500 associated with operation of the B+K.</p>	

Summary	
Use of the B+K Analyzer has resulted in significant dollar savings for both the OCVZ and Type B probing projects. The net annual savings for the two projects amounts to \$4,174,400. The combined savings for these two projects when complete may be as high as \$39,602,750.	

Worksheet 1: Operating & Maintenance Annual Recurring Costs

Expense Cost Items *	Before (B) Annual Costs	After (A) Annual Costs
1. Equipment	\$ -	\$ -
2. Purchased Raw Materials and Supplies	\$ -	\$ 2,300.00
3. Process Operation Costs:		
Utility Costs	\$ -	\$ -
Labor Costs	\$ 3,960,000.00	\$ 84,000.00
Routine Maintenance Costs for Processes	\$ -	\$ 2,500.00
Subtotal	\$ 3,960,000.00	\$ 86,500.00
4. PPE and Related Health/Safety/Supply Costs	\$ -	\$ 200.00
5. Waste Management Costs:		
Waste Container Costs	\$ -	\$ -
Treatment/Storage/Disposal Costs	\$ -	\$ -
Inspection/Compliance Costs	\$ -	\$ -
Subtotal	\$ -	\$ -
6. Recycling Costs		
Material Collection/Separation/Preparation Costs:		
a) Material and Supply Costs	\$ -	\$ -
b) Operations and Maintenance Labor Costs	\$ -	\$ -
Vendor Costs for Recycling	\$ -	\$ -
Subtotal	\$ -	\$ -
7. Administrative/other Costs (planner)	\$ -	\$ -
Total Annual Cost:	\$ 3,960,000.00	\$ 89,000.00

* See attached Supporting Data and Calculations.

Worksheet 2: Itemized Project Funding Requirements*
(i.e., One Time Implementation Costs)

Category	Cost \$
INITIAL CAPITAL INVESTMENT	
1. Design	\$ -
2. Purchase	\$ 45,000
3. Installation	\$ -
4. Other Capital Investment (explain)	\$ -
Subtotal: Capital Investment= (C)	\$ 45,000
INSTALLATION OPERATING EXPENSES	
1. Planning/Procedure Development	\$ -
2. Training	\$ 1,000
3. Miscellaneous Supplies	\$ 2,300
4. Startup/testing	\$ -
5. Readiness Reviews/Management Assessment/Administrative Costs	\$ -
6. Other Installation Operating Expenses (explain)	\$ -
Subtotal: Installation Operating Expense = (E)	\$ 3,300
7. All company adders (G & A/PHMC Fee, MPR, GFS, Overhead, taxes, etc.)(if not contained in above items)	\$ -
Total Project Funding Requirements=(C + E)	\$ 48,300
Useful Project Life = (L) 10 Years Time to Implement: 0 Months	
Estimated Project Termination/Disassembly Cost (if applicable) = (D)	\$ -
(Only for Projects where L<5 years; D=0 if L>5 years)	
TOTAL LIFE-CYCLE COST SAVINGS CALCULATION FOR IPABS-IS	
<i>(Before - After) x (Useful Life) - (Total Project Funding Requirements + Termination)</i>	
Total Life Cycle Cost Savings Estimate = (B - A) x L - (C+E+D)	\$38,661,700
RETURN ON INVESTMENT CALCULATION	
Return on Investment (ROI) % =	
$\frac{(Before - After) - [(Total Project Funding Requirements + Termination)/Useful Life]}{[Total Project Funding Requirements + Project Termination]} \times 100$	
$ROI = \frac{B-A-[(C+E+D)/L]}{(C+E+D)} \times 100 \quad 8004 \quad \%$	
O&M Annual Recurring Costs:	Project Funding Requirements:
Annual Costs, Before= \$ 3,960,000 (B)	Capital Investment= \$ 45,000 (C)
Annual Costs, After= \$ 89,000 (A)	Installation Op. Exp= \$ 3,300 (E)
Net Annual Savings= \$ 3,871,000 (B-A)	Total Project Funds= \$ 48,300 (C+E)
Note: Before (B) and After (A) are Operating & Maintenance Annual Recurring Costs from Worksheet 1.	

Basis for Estimates

1	Equipment
Three B+K Analyzers are already owned by the program. There are no current purchase costs, but the cost per unit is about \$45,000. This is inserted in Worksheet 2 as an initial cost.	

2	Purchased Raw Materials and Supplies
Sampling supplies consist of Tedlar bags, calibration costs, and gases. The reuseable bags cost approximately \$800 per year. The standard gas is about \$2,000 per year but 25% is used to calibrate other instruments, therefor \$1,500 is associated with this tool.	

3	Process Operation Costs:
Utility Costs Cost to operate the analyzer is minimal.	
Labor Costs Costs for off-site laboratory work are captured in this section. An estimate of \$3,000 per sample was provided by the SMO. With 110 samples per month and 12 months of operation per year this adds up quickly to \$3,960,000 annually. The cost to operate the on-site gas analyzer is captured here also. Based on \$50 per hour and 35 hours sampling time per week there are \$7000 in labor costs associated with use of the B+K per month, or \$84,000 per year.	
Routine Maintenance Costs for Processes There are calibration costs of approximately \$2,500 per year associated with operation of the B+K.	

7	Administrative/other Costs

Summary
Use of the B+K Analyzer has resulted in significant dollar savings for both the OCVZ and Type B probing projects. The net annual savings for the two projects amounts to \$4,174,400. The combined savings for these two projects when complete may be as high as \$39,602,750.